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Disease-a-Month

Peptic Ulcer

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TABLE OF CONTENTS

Etiology and Pathogenesis 4
Mechanism of Ulcer Pain 6
Pain Pathways 8
Natural History 10
Diagnosis 11
General Principles of Treatment 12
Role of Anticholinergic Drugs 13
Gastric Ulcer 15
Channel Ulcer 16
Marginal Ulcer 17
Complications 19
  Perforated walled-off ulcer 19
  Hemorrhage 21
  Obstruction 23
  Perforation 24
  Gastroenterocolic fistula 24
Indications for Surgery 25
Complications of Surgery 29
Long Term Management 30

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THE PREVALENCE of peptic ulcer, the frequency of recurrences and the seriousness of its complications render it one of the more important diseases of the present day. While most common in the second, third and fourth decades of life, the disease may occur in infants and children, as well as in the aged. It is no respecter of race, sex, creed, social position or economic station. The physician, therefore, whether general practitioner or specialist, may well expect to be confronted, from time to time, with the problems presented by this disease and should be prepared to cope with them.

The benign course of the uncomplicated ulcer, its inclination to spontaneous remissions and its gratifying response to conventional therapy have lulled many of us into a false sense of security in dealing with these patients. There is a tendency to give little thought to the underlying causes, to the natural history, to the factors responsible for precipitating a recurrence, to the mechanism

of ulcer pain and to the serious and often fatal complications of this disease.

ETIOLOGY AND PATHOGENESIS

Although the underlying cause of peptic ulcer is unknown, there are many factors which undoubtedly play a part in its development. A clear understanding of these factors and their relative importance is essential to the proper management of the patient having a peptic ulcer.

1. *Secretory factor.*—The role of hydrochloric acid and pepsin in the pathogenesis of ulcer has long been recognized. Peptic ulcer occurs only in those portions of the alimentary tract which are exposed to the action of acid pepsin. The dictum, "No acid, no ulcer" is generally accepted, and valid cases of duodenal ulcer in the presence of persistent achlorhydria are rare. Certainly there are no documented cases of active duodenal ulcer in patients having pernicious anemia. Although hydrochloric acid is invariably present in patients who have an active ulcer, it is illogical to conclude that acid, therefore, is the cause of ulcer. Most patients with benign gastric ulcer have normal or low acidity and some may even have achlorhydria. While the patient having a duodenal ulcer is likely to have hyperacidity, many individuals, with no gastrointestinal complaints and completely negative radiologic findings, likewise may have an excessive amount of acid. Furthermore, a duodenal ulcer will heal and recur spontaneously with no significant variation in the degree or quantity of acid present. It is difficult, therefore, to believe that hyperacidity and hypersecretion alone are responsible for the development of ulcer; there must be other factors which render the mucosa susceptible to the digestive action of acid pepsin. Undoubtedly, mucus is an important protective substance in both the stomach and duodenum and may play a major role in the local defense mechanism against digestion.

2. *Motility factor.*—Spasm and irritability in the region of an active ulcer are common radiologic observations. Some authorities believe that these findings are the effect rather than the cause of ulcer; others feel that hypermotility and spasm may be important in its pathogenesis. Conceivably these factors might interfere with

local blood supply, resulting in devitalization of tissue and subsequent ulceration and, therefore, be important in the pathogenesis of ulcer.

3. *Vascular factor.*—Experimentally, it has not been possible to produce typical chronic peptic ulcer by interference with either arterial or venous blood supply alone. However, it is reasonable to assume that lowered tissue resistance, resulting from ischemia, is important in the production of ulcer. An ulcer developing in the elderly individual for the first time probably is related directly to vascular disease.

4. *Endocrine factor.*—The role of the endocrine glands in peptic ulcer is yet to be determined. Since recognition of the adrenocorticotropic hormones, interest in this phase of the ulcer problem has been stimulated greatly. Certain characteristic changes in animals exposed to nonspecific stress, including superficial ulcerations of the gastrointestinal tract, have been demonstrated by Selye, and these changes are associated with evidence of increased adrenal cortical activity. Furthermore, acute peptic ulcers have been observed following burns, fractures and lesions of the central nervous system. It is well known that the administration of ACTH and cortisone results in a pronounced increase in both acid and pepsin (1), and reactivation of a quiescent ulcer or development of an ulcer in a previously healthy individual has followed the administration of these hormones. It is important to note that the effect of ACTH and cortisone upon gastric secretion is independent of the vagus nerve and the gastric antrum. One must not assume, however, that the increased secretion of acid and pepsin following hormonal therapy necessarily is the cause of ulcer, as there could be other factors of equal or even greater importance (2).

5. *Psychogenic factor.*—The development of an active ulcer following emotional crises is too frequent to be coincidental. The observations by Beaumont on Alexis St. Martin and more recently by Wolf and Wolff on "Tom" show clearly that anger and resentment cause engorgement of the mucosa with hypersecretion of hydrochloric acid and pepsin, while fear or insecurity has an opposite effect (3). Whether or not these physiologic changes are of etiologic importance is unknown.

6. *Miscellaneous factors.*—Various gastric stimulants have been implicated in the pathogenesis of ulcer. Among these are alcohol, caffeine and tobacco. There is no convincing evidence that these agents are of any etiologic significance.

7. *Constitutional factors.*—Why one person develops an ulcer, another ulcerative colitis and another a functional gastrointestinal disturbance, when subjected to stress, is a riddle yet to be solved. Certainly heredity plays an important part. In our ignorance, susceptibility to ulcer is called "ulcer diathesis" and the individual an "ulcer-bearing patient." This concept is of the greatest importance in understanding the ulcer problem.

In summary, it is improbable that there is a single cause of peptic ulcer. In the ulcer-bearing patient the delicate balance which prevents ulceration is easily disturbed, and stress, in its broadest sense, is probably the precipitating factor in the majority of cases. *The inescapable equation of the etiology of ulcer may be stated as follows:*

Acid pepsin plus lowered tissue resistance equals ulcer!

MECHANISM OF ULCER PAIN

The mechanism of pain in peptic ulcer has been a source of controversy for years. Some authorities are convinced that pain is due to chemical irritation of exposed sensory fibers in an ulcer crater by hydrochloric acid (4). Others believe that pain is produced by increased muscular activity or spasm at the ulcer site (5). A third group postulates that pain is the result of a disturbance of the gastric evacuation mechanism or altered motility of the stomach and duodenum (6).

Two of these factors, namely, hydrochloric acid and motility, are both variables. In order to determine the effect of one of these variables upon production of ulcer pain, the other must be rendered constant. Unless this is done, erroneous conclusions are likely to be drawn. In all probability the widely divergent opinions which exist today are due to failure to take this important point into consideration.

Studies of patients having an active ulcer, whether gastric or duodenal, using an acid barium mixture (pH 1.0) point strongly

to the importance of the motility factor in the production of pain. In 150 consecutive patients thus studied, only 50 (33%) had pain following ingestion of the acid mixture (7). Development of pain was associated invariably with altered motility, consisting of incoordination of the gastric evacuation mechanism with or without localized spasm. Furthermore, in 17 patients having a duodenal ulcer, no acid barium could be demonstrated beyond the pylorus, yet typical ulcer distress occurred. Conversely, acid barium could

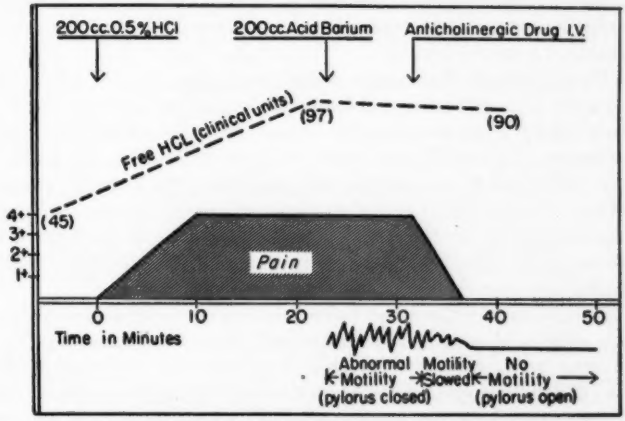

FIG. 1.—Relationship of acidity, motility, anticholinergic drugs and pain.

be demonstrated in the ulcer crater in many patients who experienced no pain at the time, and in some patients having ulcer distress, ingestion of acid barium was followed by immediate relief. Finally, relief of pain invariably followed the intravenous administration of a potent anticholinergic drug. This coincided exactly with cessation of gastric motility as observed fluoroscopically, despite the fact that the pH of the gastric contents remained unchanged (Fig. 1). It was concluded that "for the production and perception of ulcer pain, there must be: (1) a stimulus, hydrochloric acid or others less well understood; (2) an intact motor

nerve supply to the stomach and duodenum; (3) altered gastroduodenal motility, and (4) an intact sensory pathway to the cerebral cortex."

PAIN PATHWAYS

An understanding of the pain of peptic ulcer is dependent upon a clear picture of the neuroanatomy and neurophysiology of the structures of the upper abdomen (8). Nerve impulses, in this region, are transmitted over three general pathways: the parasympathetic or vagus, the sympathetic or splanchnics, and the intercostals or somatic nerves.

Physiologically the vagus nerve is concerned primarily with gastrointestinal motility and secretion. There is good reason to believe that it does not transmit sensory impulses from the upper abdomen, although it may carry sensory fibers from the trachea and esophagus. Experimental data supporting this are: (1) stimulation of the proximal end of the severed vagus (chemical, electrical, thermal or mechanical) causes no sensation in the conscious person, and (2) after complete vagotomy the pain of gallbladder disease or recurrent ulcer is perceived as usual.

Painful stimuli from the upper abdomen are transmitted over two groups of nerves, the sympathetic and the intercostal. The afferent impulse of visceral pain is transmitted uninterruptedly over the greater splanchnic nerve through the celiac ganglion, the sympathetic chain, the dorsal root, the nerve fiber making its first synapse in the posterior horn. From here it travels by way of the spinothalamic tract to the thalamus and thence to the sensory cortex (Fig. 2). Interruption of this pathway by celiac ganglionectomy, sympathectomy, rhizotomy or chordotomy results in immediate cessation of visceral pain.

Pain arising from stimulation of the somatic nerves is transmitted directly over the intercostal fibers, which proceed through the dorsal root, synapse in the posterior horn and continue to the brain in the same pathway as that of the visceral afferent nerves. Interruption of this pathway at any level results in relief of somatic pain. This close anatomic relationship between visceral and somatic afferent fibers in the posterior horn is probably the ex-

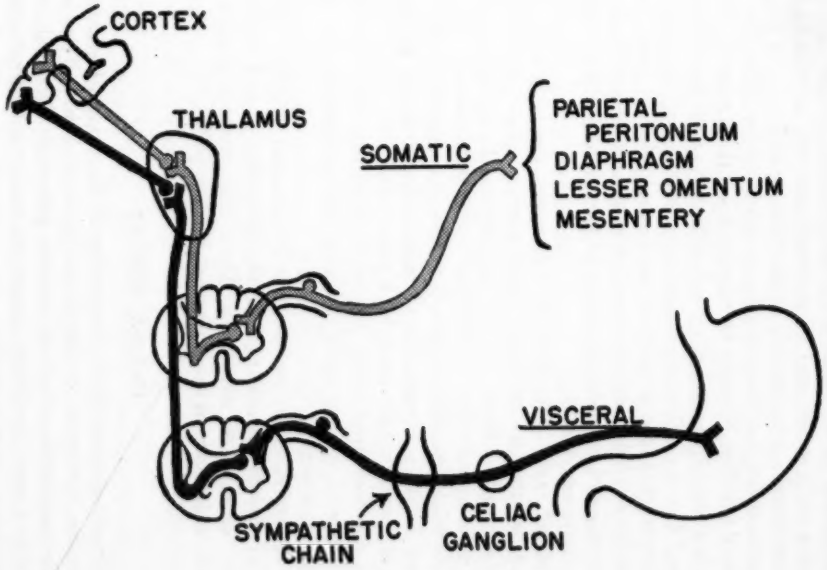

FIG. 2.—Pain pathways.

planation for referred pain by so-called "overflow mechanism." Thus, visceral pain of sufficient intensity could overflow into adjacent somatic nerves and be perceived not only as pain in the anterior abdomen but as pain in the chest or back.

VISCERAL PAIN.—Visceral pain is produced by distention or spasm of a hollow viscus or by traction upon the mesentery. This pain is often vague, ill-defined and difficult to describe. The old saying, "Our sensations transcend our vocabularies," is most applicable to this type of distress. In general, visceral pain from an uncomplicated ulcer, whether duodenal or gastric, is localized in the epigastrium and transmitted to the brain over the sympathetic segments T5-T9.

SOMATIC PAIN.—The parietal peritoneum, the body wall, the diaphragm, the mesentery and lesser omentum have a rich supply of pain fibers from the intercostal nerves. In contrast to visceral pain, somatic pain is produced by the usual stimuli (chemical, electrical, mechanical and thermal). As a general rule, an unusual location or radiation of pain is due to direct involvement of these somatic nerves by a penetrating ulcer rather than to the overflow mechanism previously described, and obviously would depend entirely upon the structures involved in the inflammatory process.

In summary, there may be two components of ulcer pain, namely, visceral transmitted over the sympathetics, and somatic transmitted over the intercostal fibers. This concept is of the greatest importance in the evaluation of ulcer pain.

NATURAL HISTORY

As in any chronic disease, knowledge of the natural history of peptic ulcer is essential to proper management. It is well known that the uncomplicated ulcer, whether gastric or duodenal, responds in a most gratifying manner to conservative treatment. Indeed, many attacks subside spontaneously. The majority of patients will have recurrences from time to time that are completely unpredictable. They are usually associated with emotional stress, dietary indiscretions, acute infections and the like, but in an appreciable number there is no apparent precipitating factor.

Complications of the disease, particularly hemorrhage and perforation, are likewise unpredictable. The patient who has bled repeatedly in all probability will have additional hemorrhages unless surgery is performed or environmental factors responsible for the recurrences can be removed. Also, the patient who has a history of perforation has a poorer prognosis than the one with uncomplicated ulcer. Fortunately the majority of patients having an ulcer never develop these complications.

The location of an ulcer has a definite effect upon the natural history of the disease. For example, an ulcer on the anterior wall of the stomach or duodenum may perforate into the peritoneal cavity with or without antecedent symptoms. Ulcers on the posterior wall of the second portion of the duodenum lie in close proximity to major blood vessels and are frequently associated with massive hemorrhage. An ulcer located in the pyloric channel is often associated with atypical symptoms and a stormy course, and those on the posterior wall of either stomach or duodenum may develop a walled-off perforation.

DIAGNOSIS

With few exceptions, a carefully taken history by a well trained person takes precedence over any form of examination in establishing the diagnosis of peptic ulcer. One depends upon the radiologist for confirmation and localization of the lesion. In the occasional patient, the clinical picture may not suggest ulcer in the least, and yet a crater may be demonstrated radiologically. More frequently one is confronted with a patient who gives a classic history of ulcer and yet radiologic evidence is lacking. It is probable that at least 5 per cent of duodenal ulcers are not demonstrable radiologically, regardless of the technic employed. Rhythmic epigastric discomfort with a nocturnal component, episodic in nature and relieved by food or antacids, and complete freedom from symptoms between attacks, especially if there is a history of hemorrhage, should be accepted as evidence of an active ulcer, regardless of radiologic findings. Conversely, upper abdominal distress which is present daily for months or years with no nocturnal component and which has an inconstant relation-

ship to meals rarely is due to ulcer, even though a deformed duodenum is demonstrated. Naturally, when complications develop, the whole picture changes. Their diagnosis is discussed later.

GENERAL PRINCIPLES OF TREATMENT

The treatment employed in duodenal ulcer necessarily is determined by the severity of the disease. For convenience, ulcers may be classified as mild, moderately severe and severe, using the intensity of pain and the degree of disability as measures of severity.

1. *Mild*—one in which a patient experiences minimal distress, relieved promptly by food or antacids, usually without a nocturnal component, radiation of pain, nausea and vomiting or disability. The patient having mild ulcer distress rarely requires hospitalization and often recovers spontaneously with no particular form of therapy. The general principles of dietary treatment which have been in practice for years are still applicable, namely, a bland diet with frequent feedings. Antacids, antispasmodics and sedatives are useful adjuncts and should be employed during the active phase. Anticholinergic drugs rarely are necessary in these cases, and their use is optional. Under such treatment prompt recovery is the rule.

2. *Moderately severe*—one which causes moderately severe pain, inconstantly relieved by the usual measures, often associated with night pain and occasionally accompanied by nausea and vomiting and radiation of pain to the back. Such patients require intensive therapy and usually hospitalization. Feedings in these cases should be frequent, every two hours throughout the day, and antacids and sedatives are indicated. Constant overnight suction is invaluable in relieving nocturnal pain so commonly seen in these patients. The anticholinergic drugs, given parenterally, are likewise extremely valuable. In the vast majority of patients a potent anticholinergic drug, given intravenously, leads to cessation of pain within a matter of minutes. A convenient practice is to give these drugs every six hours, intramuscularly, for three to five days or until all pain has ceased. After cessation of pain, it is wise to continue the anticholinergic drug by mouth for the next few weeks or months.

3. *Severe*—the distinction between the moderately severe and the severe ulcer is somewhat arbitrary. A severe ulcer may be defined as one causing incapacitating pain, not relieved by the usual measures and often requiring narcotics. Nausea and vomiting are common and night pain is a prominent feature. Intensive therapy, as described for moderately severe ulcer, should be instituted, and constant gastric suction and anticholinergic drugs, given parenterally for several days, may be necessary. The indications for surgery in these cases will be discussed later.

As pointed out previously, there may be two components to ulcer pain, visceral and somatic. Visceral pain is promptly relieved by diet, antacids and antispasmodics. Pain arising from irritation of somatic nerves, on the contrary, is more intense and may be refractory to conventional treatment. Such pain often responds only to continuous suction and anticholinergic drugs, given parenterally. Failure to improve following intensive treatment, already outlined, suggests a perforated walled-off ulcer.

ROLE OF ANTICHOLINERGIC DRUGS

The role of the anticholinergic drugs in the treatment of ulcer may be discussed under two general headings, active phase, and quiescent or interim phase.

1. ACTIVE PHASE.—When given orally, in therapeutic doses, these drugs diminish gastric secretion and gastrointestinal motility. Theoretically this response should create conditions ideal for healing, and it is generally agreed that administration of these drugs has proved highly beneficial in the treatment of active ulcer (9). The effect of the oral administration of an anticholinergic drug on a patient having an active duodenal ulcer is shown graphically in Figure 3. When given parenterally the effect of these drugs is far more pronounced, especially upon gastrointestinal motility. Peristalsis is markedly diminished and complete paralysis of the stomach, lasting 30 to 45 minutes, may occur. *In our experience ulcer pain may be completely abolished within a matter of minutes following intravenous administration.* Figure 4 illustrates the effect upon severe ulcer pain of anticholinergic drugs given intravenously.

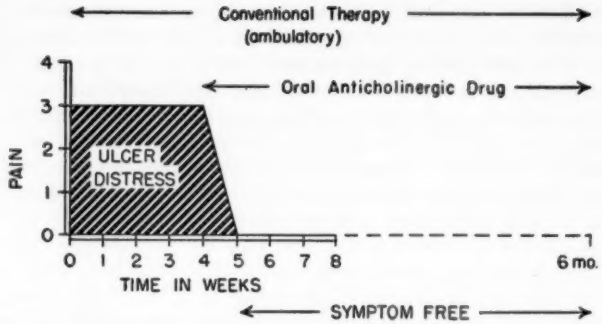

FIG. 3.—Effect of orally administered anticholinergic drugs for duodenal ulcer in a man, aged 59.

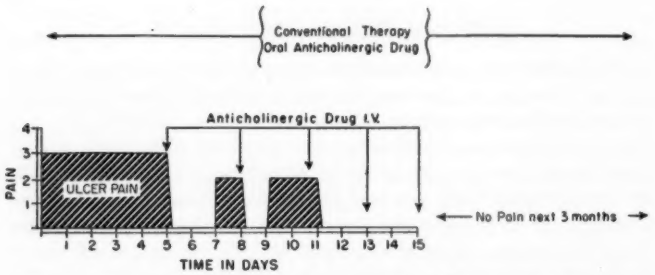

FIG. 4.—Effect of parenterally administered anticholinergic drugs, given during ambulatory therapy of duodenal ulcer in a woman, aged 39.

In summary, any patient having moderately severe to severe ulcer distress should receive anticholinergic drugs, preferably by parenteral administration, until all pain has ceased. Thereafter the drug should be continued orally for the next few weeks, until one can be reasonably sure that the ulcer has completely healed.

2. QUIESCENT OR INTERIM PHASE.—The value of these drugs in the long term management of the ulcer patient has been a subject of considerable controversy. Original reports suggested that one of these drugs was so effective as the sole treatment of ulcer that conventional medical management was no longer necessary, that recurrences and complications could be prevented and the need for surgery obviated. Many of these studies, however, were not controlled, and it is difficult to determine whether the beneficial effects attributed to the drug were actually produced by it. Recent investigations, more critically conducted, have failed to confirm some of the original observations (10). In an effort to clarify this problem, a comparative study of the effect of continuous long term administration of potent anticholinergic drugs, atropine and a placebo upon the course of peptic ulcer was undertaken. Five hundred and sixty-three patients were treated, utilizing a "double-blind study" (11). The average follow-up period was 12 months. It was concluded that those patients taking the anticholinergic drugs fared significantly better, clinically, and had fewer and milder recurrences than those taking atropine or placebos. It should be emphasized, however, that recurrences were not prevented, the frequency of complications was not altered and the need for surgery was not obviated.

From this study it would appear that the chief value of the anticholinergic drugs lies in their ability to relieve ulcer distress in the acute phase and to diminish the frequency and severity of recurrences. Their use in the interim phase is optional. *They constitute a distinct advance in the medical management of peptic ulcer but should supplement conventional therapy, never replace it.*

GASTRIC ULCER

The danger of underlying malignancy is always present and necessarily influences therapy, otherwise gastric ulcer presents

essentially the same problems as duodenal ulcer. It is often stated that the clinical picture of gastric ulcer differs from that of an ulcer in the duodenum. In our experience this is not the case, as the time relationship to meals and relief by food is essentially the same in both, except in ulcers located in or immediately adjacent to the pylorus. Gastric acidity is usually determined, but the findings are not particularly helpful in establishing the diagnosis or in outlining therapy. All patients with a gastric ulcer should have gastroscopy and, if facilities are available, cytologic studies should be made.

Treatment of gastric ulcer is identical with that of severe duodenal ulcer. These patients should always be hospitalized and the progress of healing followed carefully, both radiologically and gastroscopically. As a general rule, prompt and progressive healing occurs under intensive therapy unless there is a deeply penetrating ulcer or a walled-off perforation. The indications for surgery in these cases will be discussed later.

CHANNEL ULCER

As previously stated, the clinical picture of an uncomplicated duodenal ulcer is so characteristic that the diagnosis can be made on the basis of the history alone. It is not generally appreciated, however, that an ulcer located in the pyloric channel may give rise to a bizarre syndrome not in the least suggestive of ulcer, and the diagnosis often is missed entirely. A channel ulcer is defined as a benign peptic ulcer occurring within the pyloric channel or immediately adjacent thereto. Gross and microscopic findings of these ulcers are identical with those of the usual benign peptic ulcer. Therefore, the unusual clinical picture is due to the location of the ulcer rather than to any fundamental difference in its pathology.

In an analysis of 100 consecutive patients having channel ulcer, confirmed by x-ray studies or by operation, nausea and vomiting was the most frequent symptom, occurring in 83 per cent of the cases (12). Often it was nocturnal and episodic, occurring before meals or immediately after meals or having no relationship to meals. Occasionally nausea and vomiting without pain

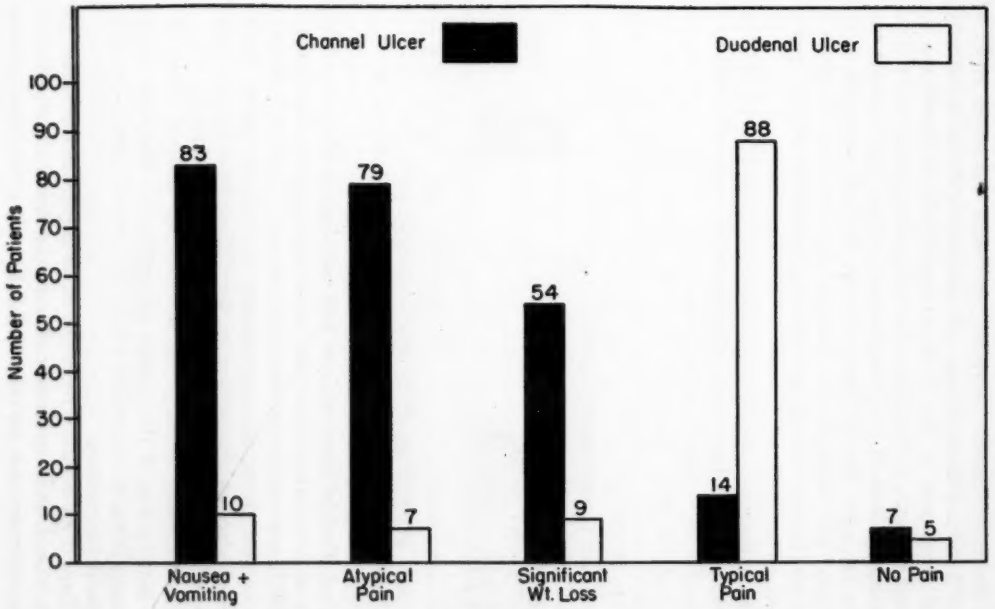

FIG. 5.—Clinical features in 100 consecutive case each of channel ulcer and duodenal ulcer.

was the only symptom. Atypical ulcer pain was noted in 79 of the 100 cases. This pain, as a rule, was totally different from the usual ulcer pain in that it often was colicky in character, unrelated to meals and unrelieved or actually aggravated by food. In many patients the pain was constant, severe and required narcotics for relief. Weight loss in excess of 15 lb. occurred in 54 patients. The incidence of channel ulcer at Duke Hospital in 1953 was found to be 4.3 per cent of all patients having a peptic ulcer.

For comparison, the clinical features of an additional 100 consecutive patients having an uncomplicated duodenal ulcer were

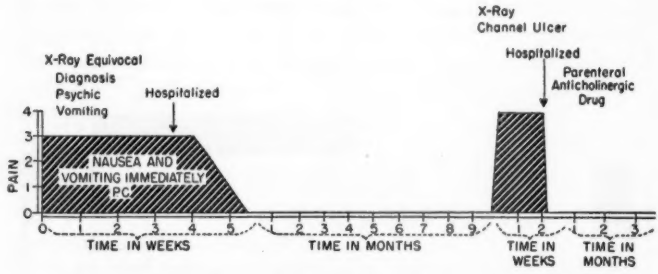

FIG. 6.—Clinical course of channel ulcer in a man, aged 29.

studied. Each of these patients had radiologic findings consistent with an active ulcer. They were all seen during the calendar year of 1953, were all hospitalized, and the analysis of their histories was carried out in the same manner as with the group having channel ulcer. A comparison of the clinical features of channel ulcer with those of duodenal ulcer is shown in Figure 5.

The radiologic findings characteristic of channel ulcer are: (1) lengthening of the pyloric sphincter; (2) distortion of the pylorus; (3) a niche located within the channel, and (4) a delay in gastric evacuation.

Channel ulcer should be suspected in any patient who has episodic nausea and vomiting or bizarre epigastric pain, especially if these symptoms are periodic and if there is a nocturnal compo-

nent. Many of these patients are misdiagnosed, and are often treated for psychic vomiting (Fig. 6).

Early diagnosis and intensive therapy, including gastric suction and parenteral administration of anticholinergic drugs are imperative if permanent pyloric obstruction is to be prevented.

MARGINAL ULCER

Pathologically the jejunal, stomal or marginal ulcer is identical with the benign gastric or duodenal ulcer. It may follow either gastroenterostomy or gastric resection and may develop months or years after the original surgery. The usual ulcer distress may be present, but often the first symptom is painless upper intestinal bleeding. It has been stated that the pain is located to the left of the midline and below the umbilicus, but this is not necessarily true. At times the ulcer becomes adherent to an adjacent structure, such as the anterior or lateral abdominal wall. In these cases there is localized tenderness accompanied by somatic pain which may be refractory to the usual methods of treatment.

The diagnosis of marginal ulcer often is difficult and sometimes impossible. All too frequently, an ulcer crater cannot be demonstrated either by x-ray study or by gastroscopy, and the diagnosis can be established only by exploratory laparotomy. Laparotomy is entirely justified in many cases of suspected marginal ulcer, especially if there has been recent hemorrhage.

The treatment of marginal ulcer is the same as that of a severe duodenal or gastric ulcer, with emphasis upon constant gastric suction and parenteral administration of anticholinergic drugs. These ulcers are frequently intractable, responding poorly to intensive medical therapy and often requiring surgery.

COMPLICATIONS

It should be pointed out that one never dies of a peptic ulcer. It is only the complication which is fatal.

1. PERFORATED WALLED-OFF ULCER.—One of the most frequent complications of ulcer, and yet the least publicized, is walled-off perforation. In an analysis of 100 consecutive cases of

perforated walled-off ulcer at Duke Hospital (13), the diagnosis having been confirmed by operation, it was found that the pancreas was invaded in 76 cases, the liver and biliary tract in 15, and in the remainder there was an inflammatory mass at the site of the perforation. Perforation into the pancreas was accompanied by pain radiating into the back at about the level of the eighth to tenth thoracic segments of the spine. Perforation into the liver or biliary tract was usually associated with pain at the angle of the right scapula with radiation to the shoulder. Jaundice occasionally occurs in such cases but was not noted in this

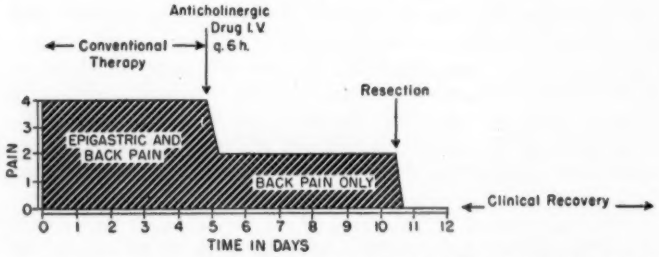

FIG. 7.—Effect of anticholinergic drugs on visceral and somatic pain of a perforated, walled-off duodenal ulcer in a man, aged 35.

series. Obviously the radiation of pain is dependent upon the somatic nerves involved by the inflammatory process.

This diagnosis should be suspected whenever there is: (1) a change in the pain pattern; (2) increase in severity of the pain; (3) radiation of the pain to the back, chest wall or shoulder, and (4) aggravation of the pain by respiration. It is important to realize that walled-off perforation may occur abruptly but more often develops slowly over a period of days or weeks. Occasionally the diagnosis may be made by the radiologic demonstration of a sinus tract or an air bubble in the vicinity of the ulcer. In most cases, however, the diagnosis can be made with certainty only by exploratory laparotomy.

The walled-off perforated ulcer is the most common cause of intractability. Intensive therapy, including a strict diet, overnight

suction and parenteral administration of anticholinergic drugs, is required. If instituted early in the course of this complication, such treatment may prove effective and render surgery unnecessary. The effect of anticholinergic drugs upon visceral and somatic pain, in a patient having a perforated walled-off ulcer, is illustrated in Figure 7. Occasionally perforated walled-off ulcer will cause back pain only, and patients with such pain may be erroneously treated for orthopedic problems (Fig. 8).

2. HEMORRHAGE.—Most patients having a bleeding peptic ulcer present no particular problem. As a general rule the diagnosis

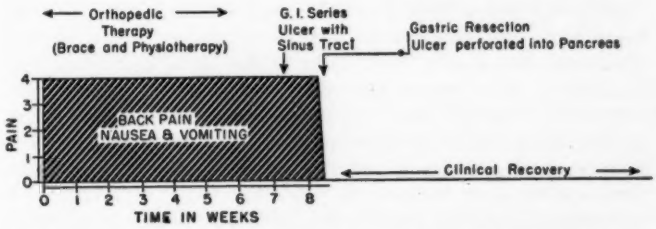

FIG. 8.—Course of a perforated, walled-off duodenal ulcer, causing only intermittent back pain for two years in a woman, aged 37.

is obvious and the response to therapy gratifying. In an appreciable number of cases, however, upper gastrointestinal bleeding presents a major challenge to the profession. For illustration, the coexistence of esophageal varices, hiatus hernia and duodenal ulcer in a patient with upper gastrointestinal hemorrhage poses a real problem not only in diagnosis but in treatment. Equally difficult is the management of the patient with silent massive hemorrhage and a completely negative result on radiologic study. The most serious problem of all is that of deciding when to perform emergency surgery in a case of massive hemorrhage or elective surgery in a case of recurrent bleeding.

Early radiologic examination is indicated if the condition of the patient permits, especially when the cause of the bleeding is in doubt. Esophagoscopy should be performed in any patient suspected of having varices, and the Sengstaken-Blakemore balloon

may be useful in localizing the site of the bleeding. In the patient with a hemorrhage of undetermined cause, localization of the site of the bleeding is essential to proper management. This can usually be accomplished by passage of a Miller-Abbott or Kantor tube to various levels of the upper digestive tract, where lavage and aspiration will reveal the presence or absence of blood.

Hemorrhage may be mild, often unrecognized, or severe, jeopardizing life itself. Early recognition and proper management may well mean the difference between life and death. For convenience, hemorrhage may be classified as mild, moderately severe, and severe.

Mild.—A hemorrhage may be classified as mild in those patients who pass tarry stools and have minimal constitutional symptoms with only a slight drop in the blood cell count and hematocrit. Such hemorrhages are probably more frequent than is generally believed. Even though the hemorrhage is mild, these patients should be hospitalized until all evidence of bleeding has stopped. Early feeding is desirable, and the principles of treatment are the same as those described previously. Transfusion is unnecessary, and the use of anticholinergic drugs is optional. Such patients should be followed carefully with respect to pulse, blood pressure, bowel sounds, blood count and stool examinations. Prompt and complete recovery is the rule.

Moderately severe.—A hemorrhage may be classified as moderately severe when hematemesis occurs or the hemoglobin level drops blow 60 per cent, the red blood cell count below 3,000,000 and the hematocrit below 30. Obviously such patients require more intensive treatment than that described for patients having a mild hemorrhage. If bleeding continues for more than 24 hours, continuous night suction should be employed, regardless of the location of the ulcer, and usually is highly effective. Transfusions are indicated, but no effort should be made to replace the total amount of blood lost. One should bear in mind that hemodilution takes place for 48 to 72 hours after the hemorrhage; therefore the hematocrit may be unreliable during this period. Blood pressure determinations with the patient in the recumbent and sitting position may prove valuable. An appreciable fall in pressure on change to the sitting position would indicate

a low blood volume and the need for additional transfusions.

Severe or massive hemorrhage.—These patients constitute a real emergency and require the attention of an efficient and well-coordinated team (the internist, radiologist and surgeon). When shock is present, the usual treatment for this condition is employed, namely, elevation of the foot of the bed, transfusions, sedation and nothing by mouth. After recovery from shock, treatment is essentially the same as that outlined for moderately severe hemorrhage. Anticholinergic drugs may be used if pain is present but should always be accompanied by simultaneous constant gastric suction. If operation is imminent, these drugs are contraindicated because of associated gastric atony and ileus. The medical management of these patients after the bleeding has ceased is the same as that previously described, and the indications for surgery will be discussed later.

3. Obstruction.—Though most ulcers occur in the duodenal bulb, one rarely sees obstruction due to an ulcer in this location. In contrast to this ulcers located in or near the pyloric channel are the usual cause of pyloric obstruction. As in the case of hemorrhage, all degrees of obstruction may be present, and, for convenience, may be classified as acute and chronic.

a) Acute Obstruction.—In the acute phase, obstruction is due to edema and spasm, and with healing of the ulcer, all symptoms of retention disappear. Obstruction of this type most frequently is due to an acute ulcer in or near the pyloric channel, and the clinical picture is that described in the discussion of channel ulcer. As a general rule, x-ray study reveals varying degrees of gastric retention without dilatation and no particular accentuation of gastric peristalsis. The diagnosis should be suspected clinically, but radiologic study is necessary for confirmation. These patients present primarily medical problems, regardless of the degree of gastric retention, and rarely require surgery. An intensive medical regimen should be instituted, including anticholinergic drugs parenterally and constant gastric suction.

b) Chronic Obstruction.—The development of chronic pyloric obstruction is usually preceded by ulcer distress that has been present intermittently for years. However, one occasionally encounters a marked obstruction without antecedent history of

pain. These patients probably have had repeated attacks of pyloric channel ulcer, manifested only by nausea and vomiting. The clinical picture of a fully developed obstruction is so characteristic that the diagnosis can be made on the basis of history alone. The usual pain pattern is lost, the pain being aggravated by food or associated with a feeling of distention immediately after meals. As the obstruction progresses, episodic vomiting of large quantities of undigested food occurs. Vomiting affords complete relief until the stomach fills again.

Physical examination is valuable in establishing the diagnosis. Large peristaltic waves occasionally may be seen traveling across the upper abdomen from left to right. An equally reliable and more frequently present sign is a succussion splash over a distended stomach. Radiologic studies will reveal a dilated stomach with little or no gastric emptying, huge peristaltic waves and a closed pylorus.

The most important aspect of treatment consists of emptying the stomach and keeping it empty. Initially the stomach should be aspirated and lavaged with a warm alkaline solution. Constant gastric suction is maintained until the obstruction has been relieved or surgery performed; and careful attention should be given to electrolyte and fluid balance. The use of anticholinergic drugs is contraindicated. As the obstruction subsides, a full liquid diet should be given during the day, with gastric lavage and constant suction at night. The decision to perform surgery necessarily depends upon response to therapy.

4. PERFORATION.—Perforation of peptic ulcer into the peritoneal cavity presents a dramatic clinical picture. It may occur in patients who have a long history of ulcer or it may be seen as the initial manifestation. Occasionally it occurs simultaneously with hemorrhage. The suddenness of the onset, the severity of the pain, the rigidity of the abdomen, the loss of liver dulness and the absence of bowel sounds constitute a familiar and easily recognizable picture. Although some advocate medical management, consisting of constant gastric suction, nothing by mouth and antibiotics, in our opinion, immediate surgery, if available, is the treatment of choice.

5. GASTROENTEROCOLIC FISTULA.—This complication is not

common. It should always be suspected in any patient who has had a gastroenterostomy or gastric resection and later develops intractable diarrhea with or without ulcer distress. A marginal ulcer is usually responsible for this complication and, as pointed out previously, may develop months or years after the original surgery. Although passage of recognizable food particles occurs in some cases, this is not necessarily present. The severe diarrhea is due to irritation of the small intestine by contents of the colon rather than to direct passage of food from the stomach to the colon itself (14). Loss of weight may be marked and obviously is due to malabsorption.

The diagnosis can be confirmed easily by radiologic study. The method of choice is the barium enema, since the communication between the stomach and bowel is more readily demonstrated by this procedure than by the usual upper gastrointestinal examination. Treatment is surgical, but the patient should be in the best nutritional state before operation is undertaken.

INDICATIONS FOR SURGERY

Indications for surgery in peptic ulcer may be divided into two large groups: (1) operations of necessity, and (2) operations of election.

1. Operations of necessity.—Surgery is indicated in: (*a*) free perforation; (*b*) complete obstruction; (*c*) uncontrollable hemorrhage; (*d*) intractability; (*e*) suspicion of malignancy, and (*f*) gastroenterocolic fistula.

a) *Free perforation.*—Within the first 24 to 48 hours after perforation into the free peritoneal cavity, surgery should be performed immediately. After this period, conservative therapy is advisable because of the high operative mortality. At one time it was felt that simple closure of the perforation was the operation of choice. The tendency today, however, is to proceed with gastric resection, provided the condition of the patient permits.

b) *Complete obstruction.*—Obviously, high grade obstruction unrelieved by conservative therapy requires surgery as soon as the patient can be properly prepared. Gastric resection is the operation of choice if the patient's condition permits. In the elderly

debilitated patient, simple gastroenterostomy probably is wiser. Surgery in patients with partial obstruction will be considered under elective procedures.

c) *Uncontrollable hemorrhage.*—The decision to perform surgery as an emergency procedure for a bleeding ulcer is one of the most difficult problems in medicine. Certainly the patient who continues to bleed, requiring constant transfusions to prevent shock, should be operated upon without delay. The patient who has repeated massive hemorrhages within a matter of days, in spite of the best care that can be instituted, should also have emergency surgery. Probably the most difficult case of all is the "slow bleeder"—the patient who does not go into shock, but continues to ooze small amounts of blood after the initial hemorrhage. It is difficult, sometimes impossible, to determine by the usual methods whether or not the bleeding in such cases has actually ceased. The clinical picture of the patient, the pulse rate, the blood pressure and hematocrit determinations are sometimes unreliable indicators of the presence or absence of continued bleeding. A new procedure is now available which promises to be of value in these cases (15). The total red cell mass can be measured accurately by the intravenous injection of chromium-51-tagged red cells. Determinations of the red cell mass at frequent intervals, as well as the finding of radioactive material in the feces, will give reliable information concerning further blood loss. Continued slow bleeding after a period of four to five days of intensive therapy is an indication for immediate surgery.

d) *Intractability.*—Intractability is usually due to a walled-off perforation. The patient whose pain persists in spite of the best medical care, including constant suction and parenteral administration of anticholinergic drugs, should have a gastric resection without delay.

e) *Suspicion of malignancy.*—Any patient having a gastric ulcer whose history, radiologic or gastroscopic findings suggest malignancy should have an exploration at once. Although benign ulcer may occur on the greater curvature, the high incidence of malignancy renders operation mandatory for ulcers located in this region.

f) *Gastroenterocolic fistula.*—Once the diagnosis has been

made, the fistula should be closed at the earliest possible moment. Because of the poor nutritional state of the patient, the surgery performed should be minimal, with resection deferred until later.

2. OPERATIONS OF ELECTION.—*The uncomplicated duodenal ulcer is not a surgical problem.* Elective operation should be considered in: (*a*) severe duodenal ulcer; (*b*) partial pyloric obstruction; (*c*) repeated hemorrhage, and (*d*) gastric ulcer.

a) *Severe duodenal ulcer.*—The indications for surgery in the patient who has a severe duodenal ulcer necessarily depend upon the response to medical treatment. The patient whose pain disappears under hospital care but recurs as soon as he resumes his usual activities is certainly a candidate for elective surgery. A much more difficult problem is presented by the patient who recovers following conservative treatment but continues to have incapacitating recurrences at frequent intervals. Economic, social and psychologic factors must be taken into consideration in such cases. Certainly it is unwise to withhold surgery from the patient who is partially incapacitated by his disease when in all likelihood he would be completely rehabilitated by gastric resection. However, *one should bear in mind that surgery, like marriage, "Is not by any to be entered into unadvisedly or lightly,"* but should be undertaken only after the most careful consideration, weighing the benefits to be expected from the procedure against the danger, the inconvenience, the expense and possible untoward effects of operation.

b) *Partial pyloric obstruction.*—The need for surgery in patients who have pyloric obstruction depends entirely upon whether the obstruction is due to edema and spasm or to cicatricial narrowing. As indicated previously, patients having obstruction resulting from edema and spasm usually respond promptly to medical treatment. On the other hand, obstruction due to cicatricial narrowing is often a surgical problem, the degree of obstruction being the determining factor. Certainly minimal six hour gastric retention with no dilatation should be treated conservatively. On the contrary, high grade obstruction, particularly if there is demonstrable dilatation of the stomach, responds less well to medical management. In our experience, patients who

have less than 50 per cent six hour retention do well under medical therapy, whereas those who have greater than 50 per cent six hour retention eventually require surgery. Although it is unwise to be guided by percentages, which admittedly are approximations only, the figures mentioned above, along with careful consideration of the clinical picture, are helpful in the management of such patients.

c) *Repeated hemorrhage.*—The decision to perform elective surgery in these cases frequently is difficult. Contrary to the opinion of some authors, the age of the patient should not materially affect one's judgment. The severity, the frequency and the character of the bleeding should be the determining factors. The availability of medical facilities, the general physical condition of the patient and the patient's own reaction to surgery are likewise important considerations. Obviously, infrequent episodes of mild hemorrhage do not constitute an indication for surgery. On the other hand, repeated attacks of massive bleeding requiring transfusions point clearly to the wisdom of operation, as it is well known that in such patients hemorrhage is likely to recur.

There is a small but important group of patients who have repeated upper intestinal hemorrhages with the usual ulcer distress and completely negative x-ray findings. It is unwise for the physician to conclude that an ulcer is not present in such cases, as at least 5 per cent of duodenal ulcers and many channel ulcers are not demonstrable radiologically. Therefore, if a patient has a typical history of ulcer distress associated with repeated episodes of upper intestinal bleeding, it is reasonable to assume that he has a bleeding ulcer and should be treated accordingly. In those patients who have recurrent hemorrhage without a history of ulcer distress and a completely negative result on examination, exploration should be advised, provided the site of the bleeding can be localized.

d) *Gastric ulcer.*—Surgery in gastric ulcer is still a highly controversial subject. Many feel, because of the danger of malignancy, that all gastric ulcers should be resected promptly. A more conservative attitude, however, is held by most gastroenterologists, who recommend surgery only in those patients whose ulcer does not heal completely within four to six weeks. The large

penetrating gastric ulcer should be removed not because of the danger of malignancy but because of intractability. An ulcer crater located high up on the lesser curvature should be treated medically because of the technical difficulties of surgery and the unfavorable effects of total gastrectomy.

COMPLICATIONS OF SURGERY

Although operation is mandatory in some patients and optional in others, there are complications of surgery which may prove distressing and remind one of a quotation from Shakespeare, "And makes us rather bear those ills we have than fly to others that we know not of."

1. DUMPING SYNDROME.—There are no reliable data on the incidence of the dumping syndrome following surgery. It is probably far more prevalent than generally realized and, unless specifically looked for, often is missed. In our experience, the most common symptoms are: nausea, shortly after meals with or without vomiting; palpitation of the heart; profuse sweating, and occasionally diarrhea. It has been shown that these symptoms may be produced by distention of the intestine at the site of the anastomosis by either a balloon or hypertonic solutions. Hypoglycemic reactions are much less common and occur several hours after meals.

There is no treatment which is entirely satisfactory, although the symptoms are somewhat alleviated if the patient lies down immediately after eating. A high protein, low carbohydrate diet with only three feedings per day should be advised, and fluid intake should be restricted between meals. Antispasmodics and sedatives are reported to be beneficial and parenteral administration of anticholinergic drugs immediately before meals is advisable. Although symptoms may be severe and incapacitating, in general the syndrome gradually subsides with the passage of time.

2. MALFUNCTIONING STOMA.—This complication is related to surgical technic and will be mentioned only in passing. At times the condition is so severe as to require corrective surgery shortly after the original operation.

3. MALNUTRITION.—It is common experience that following partial gastric resection many patients do not regain their preoperative weight. The weight loss apparently is related not to diminished caloric intake, but rather to faulty absorption. In some cases this is of no particular consequence and requires no special treatment. In others, however, the weight loss is a serious problem, responding poorly to therapy and causing varying degrees of disability.

4. ANEMIA.—Anemia following partial resection is not common and when present is usually nutritional in origin. This type of anemia responds promptly to the administration of iron by mouth, supplemented by ascorbic acid, although iron intravenously may be necessary. Rarely, a macrocytic anemia develops, presumably due to the lack of the intrinsic factor, and requires the parenteral administration of B_{12}. All patients in whom gastric surgery has been performed should have the blood picture watched closely for months or years.

LONG TERM MANAGEMENT

Although the treatment of the patient who has an acute ulcer, with or without complications, is an all-important immediate problem, of equal importance is the long term management of the ulcer-bearing patient. Once the ulcer has healed, or the perforation has been closed, the hemorrhage stopped or the obstruction relieved, the physician is again confronted with the problem of long range therapy.

What steps can be taken to prevent a recurrence, a perforation or hemorrhage? Can one assure the patient that if he follows a prescribed diet, takes medication as directed, avoids alcohol, tobacco and coffee he will have no further trouble from his ulcer? Will the administration of anticholinergic drugs, over long periods of time, prevent recurrences and lessen the likelihood of complications? Unfortunately, *the anwser to these questions is—No!* In all honesty, one must admit that an ulcer may recur in spite of complete cooperation by a conscientious patient. The ulcer-bearing patient may expect a recurrence of his ulcer any time that he is emotionally disturbed or is subjected to un-

due stress. Nevertheless, careful attention to one's diet, avoidance of all gastric stimulants and a satisfactory social, domestic, occupational and environmental adjustment tend to reduce the frequency and severity of recurrences.

The continuous and prolonged administration of drugs in the treatment of ulcer is a subject of considerable controversy. Although neutralization of acid is an essential feature in the treatment during the active phase, it is doubtful that the continuous administration of antacids is of any particular value in the prevention of recurrences or of complications. The same general statement applies to the antispasmodics. However, patients taking anticholinergic drugs continuously, over a long period of time, have been shown to fare significantly better and have fewer or milder recurrences than those taking atropine or a placebo. Therefore, their prolonged administration to the ulcer-bearing patient may be justified. A more practical use of the anticholinergic drugs in long term management would be to advise their administration coincident with the onset of ulcer distress and to continue them for several weeks after subsidence of symptoms.

Education of the patient concerning the known factors in the pathogenesis of ulcer is of greater importance than any diet or medication that can be prescribed. The prompt treatment of symptoms when they recur, either at home by the patient himself or preferably in the hospital by a physician, will do much to prevent severe recurrences and serious complications. *The patient should be taught to live at peace with his ulcer and his environment, to accept a partial disability philosophically, to expect recurrences from time to time and to treat them promptly and intelligently, turning to surgery only as a last resort.*

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